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BINOCULAR VISION AND THE PROBLEM OF KNOWLEDGE.¹

By Professor JAMES H. HYSLOP, Late of Columbia University.

It was the doctrine of Kant that gave importance to the problem of space perception. Had it not been for that philosopher's paradoxical assertions about the nature of space and its perception we should probably have taken this datum of knowledge as a dogmatic object of faith. Previous to Kant no special theory of knowledge or metaphysics depended upon any particular doctrine of space and its perception. But the great Königsberger formed a definite theory of it and drew certain philosophic consequences from it. This theory consisted in a double qualification of its nature. He described it as a "form of intuition," and qualified this as apriori and subjective. That space was a "native" or intuitive perception was the accepted doctrine after Descartes, but none had attempted to describe this "native" perception as subjective until Kant ventured upon the assertion. The consequent idealization of knowledge and reality, whatever such idealization meant, had so many revolutionary implications in philosophic thought that it created much offense in the ranks of common sense and science. Common sense did not like the idealism founded upon it and the scientist did not like the concession to apriori doctrines involved, inasmuch as induction and experience were the watchwords of the scientific movement. Both schools of thought conceived it their interest to attack the Kantian philosophy by depriving it of the foundation which Kant had placed in the apriori and ideal nature of space and time. The scientific man attacked its apriori nature and the common sense philosopher attacked its ideality. Between the two it was

¹ It was my study of space perception under President G. Stanley Hall, while at Johns Hopkins University, that first interested me in the problems here discussed and prepared the way for all my later investigations of them.

hoped to eradicate the system. The consequence was a vast literature and direct experimental investigation to determine the issues raised by the alleged significance of the Kantian doctrine of space and time. The fact was, however, that the system was less dangerous to science and less antagonistic to the existing philosophy than was supposed. The real conflict between science and transcendentalism lay in their associations. The one was liberal and the other conservative in its affiliations. Science had attached itself to progress and revolutionary tendencies. Transcendentalism, whatever its sceptical impulses, had easily adjusted itself to the conservative institutions of society resisting change and the dissolution of traditions. As the system depended upon the *a priori* nature of space and time the scientific mind resolved to remove this keystone to the arch of the structure and consequently directed its investigations to this end, assuming that it had not to discuss any of the larger philosophic problems ostensibly founded upon the doctrine of space and time.

The outcome, however, has not been what was expected. It was thought that the disproof of the *a priori* perception of space would disqualify the idealism founded upon it, but, as the Nemesis of scepticism would have it, Wundt, an empiricist in the doctrine of space perception, definitely claims that this view affords a better basis for the Kantian idealism than Kant's own conception of its foundation. In fact the solution of the problem has been found not to be so easy as was at first imagined. The complexities and equivocations involved in it suffice to take the dogmatism out of the theories on both sides and now one does not care whether space perception be empirical or *a priori*. No such philosophical consequences as Kant claimed for it are recognized by any of the parties to the controversy about the *genesis* of our idea of space, but only its *nature*, whatever its genesis. Hence the issue has completely shifted from the psychogonical to the epistemological and metaphysical problem which lies on the boundaries of metaphysical speculation.

The immemorial problem of knowledge has been connected with the question whether we could ever know anything beyond our mental states and affections. In thus defining it I

am not ignorant of the complexities and equivocations of such a formula lurking in the term "knowledge," "beyond," "mental states," etc. I am only stating a formula which at least appears to limit "knowledge" to the functions of the organism or mind in the sense that its boundaries are to be defined by the limits of the organism itself. It is not my task here to define and analyze the formula or determine what is true or false in it, but only to indicate that the result of antecedent conceptions has brought men to formulate their conclusions in this language with its apparent import. How this movement began we shall see in a moment. But long after it had seized speculation the triumphant refutation of scepticism was based upon the accepted integrity, the objective import, of our ideas of space and their impregnability against sceptical analysis and attack. But the Kantian claim that space is "subjective and ideal," whatever Kant may have meant by his terms, reanimated the old controversy, and at least in the light of the traditional conceptions and implications of the terms "subjective and ideal" suggested the limitation of knowledge to states of consciousness in a more radical sense than ever. While previous thought, accepting the relativity of our knowledge of matter, had still remained by the objectivity of space, the new position taken by Kant left the imagination with nothing but the subject and its own evanescent states as the objects of knowledge. What it meant in the field of perception was that we could *perceive* only what we *have* "in" experience; that is, nothing "outside" consciousness, and so at least apparently outside the organism, could be seen or known. The range of the knowable was limited to the states known.

The phenomena of illusions have been the most important influence in suggesting the way in which the limits of perception shall be determined. They indicate that the supposed reality beyond the mental state, which is so confidently assumed in normal conditions, may be nothing more than the subjective act. The resemblance between the illusion and the normal state, between the phenomenal and the real, is so close that the unity between them is gotten by eliminating the "reality" of the normal, the only difference between them being that reality which may be assumed to be inferential and so

liable to error, so that certain knowledge appears to be limited to the subjective. Valid perception seems thus to be realized as fully in illusions as in the supposed normal consciousness, the reality of whose external object appears dubious because it is inferential. Briefly stated again, we can only perceive what we have; knowing and being are identical.

The rise and development of this conception is an interesting bit of history. I mean, of course, in reflective and speculative thought. The whole doctrine got its inception from the naïve materialism of Empedocles which was probably a reflection of common notions at the time. The manner in which Empedocles accounted for sense perception by the impact of the eidola or corpuscular effluvia upon the sensorium, eidola which were the *fac simile* of the objects from which they were projected, appears to us absurd enough, especially from the point of view of evidence, but it illustrates clearly the assumption that there is some qualitative resemblance between the "impression" and the stimulus or cause of sense perception. The figure of the seal and the wax, even in Aristotle, carried the same implications with it and probably affected the conceptions of antiquity to a large extent. The Greek admitted the distance of the object from the sensorium, but could not account for the knowledge of it without importing into the problem the conception of contact with the subject and a structural resemblance between the object and the "impression;" that is to say, though knowledge was not limited to the subjective state, there was some kind of identity between objects and knowledge, the "reality" and the "impression" were similar, the intermediate distance between them being traversed by eidola resembling both of them.

But this corpuscular theory was very soon supplanted by the doctrine that it was not eidola but motion that passed from the object to the subject and served as the stimulating cause of sensation. Here the whole conception of the case was changed. In the Empedoclean view the assumption of identity between "impression" and eidola, and between eidola and object, sufficed to justify the belief about the nature of the object. But in this new view, depending upon the mediating and causal agency of motion, there is no definite indication at first that

motion and object were like each other. In fact it was rather distinctly assumed that they were different, and as the older conception of the object still prevailed the analogy of the seal and wax did not apply. The inevitable tendency of the new conception was to set up an antithesis of kind between some of the data involved in perception. There were three things to be considered: object, motion and impression. Until Plato came to revise the problem the motion was not like the object, and the problem at once arose to determine how the external object, separated from the impression and unlike the mediating cause, could be known. The consequence was that perception was limited to the sensory state, whatever that was, and the supposition was that this was no indication either of the fact or the nature of the object. Hence we see the logical outcome in the doctrine of the Sophists which was reinforced by the general relativity of knowledge, this being based upon the fact of illusions as well as the assumption of contact with the organism as a condition of knowledge. The Sophist still assumed the identity of "object" and "impression" (thought and reality), but he did not locate the object beyond the subject in his conception of the thing "known." There was an antithesis between the "object" as external and the "impression," but this "object" was *nil*.

The most important thing to remark at this juncture of the matter is the fact that later thought never returned to the naïve conceptions of Empedocles in order to render the process of perception phenomenally intelligible. The speculative philosopher felt obliged, in the field of vision, to abandon the conception of contact as an explanation of perception and consequently had a perpetual puzzle before him in the question, "How can we perceive what is not consciousness, or in contact with the organism?" How can objects at a distance be known at all? Presumably they are not so known in tactual experience, which is the most fundamental source of our conception of "sensation," according to the usual assumptions, where vision is predominantly the *perceptive* sense and touch the measure of *sensation*. In tactual experience the supposed external object and the sensation have the same locus, the sensorium or organism: in vision the common assumption is that the object is not in

contact with the sensorium and the very existence of a sensation is an inference from the experience of touch. But as the motion (vibration in modern parlance) which is supposedly emitted from the object does not represent the object in kind, but does satisfy the principle of contact, according to the accepted view, in visual experience, and as tactual experience and the assumptions associated with it determine the tendency to interpret sensation as functionally limited to the locus of the sensorium, the inevitable tendency is to interpret visual phenomena in terms of the principles assumed in touch, the object being and acting where it is, or is not seen at a distance, so that in sight the same conception comes to determine the mode of conceiving its phenomena. Apparently we seem forced to interpret vision by touch or touch by vision. If vision is to be explained by the assumptions of tactual experience, these being conceived in terms of contact, visual perception has the same limitations. If touch is to be interpreted by the analogies of vision where the object is supposed not to be in contact, we come into conflict with the fact that we do not perceive the tactual object at a distance. The consequence is that we get our unity of thought and conception in the general idea of sensation which limits its nature and meaning to the area of the sensorium; and the object must be there to be known, or if supposed to be at a distance, it is apparently a conjectural thing. Now as the principle of identity had all along been assumed to determine all intelligibility in experience, this new assumption of an antithesis between thought and reality, of difference between sensation and the object, if it existed and was not present in consciousness spatially or temporally, only availed to make an object an unintelligible notion, in all conceptions of it as at a distance, with motion as the mediating agency for affecting the sensorium. In other words the tendency arises to interpret vision by the assumptions and conceptions of touch, which involves contact as its standard of judgment; and to consciousness the object at a distance is *nil*, or conjectural. Consequently the definite knowledge of vision was, like touch, limited to the states of the sensorium. Or to put the same thought in another way, what is not a qualitative part of the "impression" cannot be "known."

This conclusion brings us to the doctrine of Berkeley who seems to have been under the influence of assumptions which he did not analyze. His whole discussion of space perception was governed by the supposition that what was not "in" the sensation or impression could not be perceived, or that we could perceive only what was in the sensation. This doctrine was embodied in the formula "esse is percipi."

The most important fact to note in Berkeley's position is his argument to exclude the nativity of the visual perception of the third dimension. The argument used by him against the organic and natural perception of distance in vision was that the third dimension was not found in the image on the retina. At the very outset of his "Theory of Vision" he says: "It is, I think, agreed by all that distance of itself, and immediately, cannot be seen. For, distance being a line directed endwise to the eye, it projects only one point in the fund of the eye—which point remains invariably the same, whether the distance be longer or shorter." In a later section he says: "It is plain that distance is in its own nature imperceptible;" again: "From what hath been premised, it is a manifest consequence, that a man born blind, being made to see, would at first have no idea of distance by sight; the sun and stars, the remotest objects as well as the nearer, would all seem to be in his eye, or rather in his mind." These quotations suffice to show that Berkeley thought the presence of the third dimension or solidity in vision was necessary to its immediate perception by that sense. The plausibility of the assumption rested upon the supposed fact that plane dimension was found in the retinal image precisely as conceived, while it was clear from the law of optics in the transmission of light and the production of images that no solidity was present in the impression. The assumptions of touch and contact were his principle of interpretation and carried with them his doctrine of "esse is percipi." But when he came to discuss the perception of plane dimension he denied its nativity on other grounds than the absence of it in the retinal impression and virtually abandoned the assumption which was so necessary to the validity of his argument regarding solidity. He based the denial of the nativity of magnitude or plane dimension upon the relativity of the perception

of it, that is, upon the quantitative variations between the dimension of the image and the dimensional quantity of the object seen. But as his argument against the native perception of solidity was based upon the assumption that, to be known directly, it must be in the image, he ought to have seen that the admission of plane dimension in the retina, whether quantitatively identical and corresponding to the dimensional quality of the object or not, was necessarily a guarantee for the nativity of the space percept in plane dimension, so that the facts to which he appealed to disprove it only showed a quantitative difference between the retinal quale and that of the object. In fact, it was logically necessary to admit or assume the nativity of plane dimension in order to make the fundamental argument good against the nativity of the third dimension. For if that were not true there was nothing to prevent the supposition that solidity was native in spite of its absence from the retinal impression. But since the assumption of plane dimension in the retinal image, according to the use made of it in regard to solidity, enforces a conclusion which is contradicted by the conclusion from the relativity of magnitude, as drawn by Berkeley, and since his doctrine denied the nativity of space perception throughout vision, we can only conclude that this denial had to be maintained independently of the question whether the retinal image contained the dimensional quale perceived. The abandonment of this point of view, however, indicates either that his fundamental assumption was not valid or that his consistency required him to admit the nativity of plane dimension in spite of the differences between the image and the dimensional quale of the object, at least in quantity. For he must admit either the nativity of plane dimension or that its presence in the image does not determine its perception. The former alternative contradicts his doctrine, the latter contradicts his assumption necessary to prove the acquired character of the third dimension in vision. Now if the presence of the dimensional quale in the image does not necessitate its natural perception, its absence from the image certainly cannot prevent the perception of it directly. This is the necessary consequence of the argument adopted by Berkeley, and it means that we cannot assume that the quale known is neces-

sarily a part of the content or nature of the "impression." That fact once granted the whole Berkeleyan doctrine is groundless. It will be apparent from such a result and from the supposition that the percept may not be a part of the "impression" that the doctrine of perception as conceived by the phenomenalist and idealist must be profoundly affected thereby, whether for good or ill.

We know that Berkeley explained the visual perception of space by association, or suggestion from muscular and tactal experience. But it never occurred to him that it was quite as easy to raise the sceptical question in regard to the nativity of space in touch as in sight. Of course, he was not likely to suspect this, as his assumption of the principle of contact and the representation of the quale perceived in the impression induced him to accept tactal space without analysis or scepticism. It was all very well for a paradoxical philosophy to beg the question in one of the senses while applying criticism in another. But the fact is, it appears to me, that there is no more reason to suppose that space is native in touch than in sight. Berkeley's argument may puzzle those who cannot have the last word with a philosopher, but it does not disturb the equanimity of those who feel as capable of deciding what they see with their eyes, whether subjective or objective, as they are of deciding what they can feel with their hands. Of course, we may neither see nor feel anything. I shall not deny a consistent scepticism. But I should not be troubled any more with the phenomena of vision than with those of touch. I agree that there is a quale in touch that becomes associated with another in sight, that a certain fact in vision will have a certain associated meaning in touch. But that they should be identical is to admit the presentation of the same datum in both senses, a doctrine which it was Berkeley's object to deny, namely, not only the nativity of space in vision, but also the view that a quale could be perceived which was not in the impression.

Now whatever we may think of Kant's doctrine of space and its perception, it is certain that he cleared up a great deal of confusion by asserting the ideality of space. He did not enter into any analysis of the percept in relation to the different

senses. Whether he should have done so or not it is not necessary for our present purposes to inquire. It is simply the fact that he did not investigate the problem whether or not it involves a synthesis of several sense perceptions with an abstraction of their common content. He in fact denied that it was an abstract idea or general concept. But his general doctrine that it was subjective and ideal as well as *a priori* was the most radical limitation of perception to what was in the impression that had been made. He put forward no paradoxes like Berkeley to prove his system. He simply asserted its ideality and allowed the logical trend of philosophy to accept it without specific or experimental proof, and it cut up by the roots all motive for any other perception of space than what could be affirmed of any other quality of experience. Nothing could be seen which was not presented or represented in the sensory impression or the act of consciousness.

With this outcome of the development of the problem of perception let us see how the phenomena of binocular vision affect both the Berkeleian and the Kantian doctrines. There are just two things to discuss in it. They are (1) the question of its nativity, and (2) the question of its ideality.

I shall confine my discussion of the first of these questions to the problem of solidity or the third dimension in the field of vision. I shall assume, for the sake of argument only, that plane dimension is present in the retinal image, and assume that the absence of the third dimension in it creates a perplexity in the perception of solidity. It was all very easy and plausible for Berkeley and his followers to try to explain this perception of the third dimension in vision by the association of tactful and muscular experiences with certain signs in vision, as they assumed the necessity of the presence in the impression of the quale to be naturally seen if it were to be supposed a native function of that sense. But Brewster's and Wheatstone's work on binocular vision, showing that the perception of the third dimension was connected with the existence of disparate images on the retina, suggested the existence of an organism for the native perception of distance which Berkeley did not suspect, all this work having been done after his time. We know how this led to the invention of the stere-

oscope and what this instrument was designed to illustrate. This was the production artificially of disparate images on the retinas for the purpose of eliciting the perception of solidity. The same effect also we know from the multitude of experiments in artificial combination of images by the use of the naked eyes, all of them illustrating the effect of the fusion of disparate images on the retinas when there is sufficient resemblance between them to effect this without too much rivalry. Instead of repeating any of the facts here which I wish to use for argument I shall simply refer the reader to papers already published. The reader may consult the following: *Mind*, Vol. XIII, pp. 499-526; Vol. XIV, pp. 393-401; Vol. XVI, pp. 54-79; *Psychological Review*, Vol. I, pp. 257-273, 581-601; Vol. IV, pp. 142-163; pp. 375-389 (this last reference is to Prof. Judd's article). Helmholtz, *Physiologische Optik*. Le Conte, *Sight*. I might also refer to the work of Hering, Aubert, Wundt, Stumpf, Lipps, and Martius.

The experiments recorded and described in these references exhibit the fact that geometric figures can be so drawn as to produce binocular parallax similar to that of solid objects on the retina and that the effect on the perception of distance or solidity is the same. They are simply variations of the phenomena of stereoscopic vision. Now Wheatstone showed with sufficient conclusiveness that the perception of solidity was associated with the existence of disparate images from solid objects and these diagrammatic experiments referred to above show the same fact with variations in a manner to indicate that there is a native function in vision to perceive the third dimension, a function at least apparently distinct from every form of association and inference. Whether it is properly so or not I shall examine presently. But what I wish to note first is the fact that this solidity is not present in the image on the retina. We may say that it is *represented* there by the binocular parallax or disparate images. It is true that there is something in binocular images different from the monocular, but this difference is not identical with the difference between plane and solid dimension. The difference is purely a matter of parallax in plane dimension or magnitude: while the perceived quale represents the third dimension. In such cases we un-

doubtedly *see* what is not in the "impression." There is no representative correspondence between the "sensation" and the quality seen. Its nativity is apparent in the fixity and uniformity of the phenomena, and the variations in a manner contradict the theory of association which ought to make the result capricious and variable. That is, if association and inference be the interpretation of the phenomenon, the perspective or solidity ought to involve localization as alterable as it is in monocular vision where geometric figures can have their form and apparent solidity seen pretty much as we will. Take the case of the geometrical cube as an illustration. We can see the cube in more than one position, if we think of the way we wish to see it. Also geometrical figures representing a tube or tunnel, which may be made to appear with the small end nearer or farther from us, as we wish to see it. But this phenomenon does not occur in the experiments with binocular perspective, unless we destroy the fusion and reduce the perception to the monocular. The organic character of it and the variation of the solidity according to the laws of fusion show that it is natural. I do not care what may be said of its evolution. Anything may be granted here. I am concerned only with what it is now in the experience of the human race. This is that there is an organic function for the perception of solidity in vision without having this quale present in the image.

I must call attention to an interesting difference between the experiments with geometrical figures and the facts of perception in normal cases of solid objects. There are two facts to be observed in normal binocular vision in the "impression," one of them involving apparent variations from purely geometrical considerations. There is first the purely geometrical disparateness of the images produced by solid objects. This is the same as in geometrical figures. But the second fact is that in actually solid objects the parallax involved in the disparate part of the images is accompanied by some slight difference in the intensity, relative or absolute, and mathematical perspective, as compared with the common part of the images. This might be said to be an important factor in the clearness of the third dimension in visual perception. While I admit that

it may affect either the judgment, supposed by the associationist, or the perception supposed by the perceptionist, it is evidently not the decisive factor in the case, because in the experiments with geometrical figures this difference of intensity in light and the existence of mathematical perspective are absent and the perception of solidity is apparently quite as clear as in actual instances of solid objects. That is to say, the perception of the third dimension is not apparently affected by any circumstances but that of mathematical disparateness and parallax, so that inferential factors supposedly associated with variations of intensity and mathematical perspective are excluded from view. In the experiments, therefore, with geometrical figures we have the clearest evidences of the nativity of the perception of distance, against the claim of Berkeley, without the presence of that quale in the image or impression.

The associational theory is easily disposed of with the remark that there is no reason for denying that tactful and muscular space become associated with the visual quale which I have been discussing. But this fact does not involve any identification of the tactful and muscular quale with the visual. What I am discussing is the visual quale *seen* directly and not its inferred or associated correlate in experience foreign to sight. We may very well discover by experience that a certain visual fact is associative with a certain tactful and muscular fact, not identical with it as a presentative percept, though a space content be in both. Hence I deny the associational theory by admitting it, while refusing to accept its relevance to the problem before me, which is not whether the visual quale has no tactful and muscular correlate, but whether there is not a visual percept that may be called the third dimension in that sense whether interpretable or not in equivalents of other types of experience. The visual third dimension has its correlate in tactful and muscular phenomena, but it is not constituted by them. The reason that confusion arises is that vision is our anticipatory and touch is our protective sense. This fact always makes it necessary to interpret our visual experience in tactful and muscular terms or correlates as a means of regulating our volitional actions and adjustments. But this utilitarian consideration in the process of development does not in-

terfere with the nativity of the visual space quale any more than the associability of a taste with a color proves the empirical character of the latter.

If "experience," association, and "motor" phenomena are to be entitled to any consideration in the case, so far as my conception of the problem is concerned, they must be confined to the sense of vision whose data alone I am discussing, and simply for the reason that an associative tactful and muscular correlate is admitted in the case but refused the right to be considered the whole of the phenomenon. It is clear that within the sense of vision association does not determine the result, and any other association is irrelevant when true. That distance is a "motor" phenomenon in vision does not alter the contention here made, namely, that the perceived quale is not, as perceived, a part of the retinal impression. You may interpret "motor" phenomena any way you please. I am not concerned with the interpretation or with the truth or falsity of that doctrine. The position that there is a visual quale for the third dimension is wholly independent of that controversy.¹

¹ My own position on the "motor" theory of space perception has not been altered in the least by anything that I have seen before or since my own experiments were published. Prof. Judd (*Psychological Review*, Vol. IV, pp. 375-389) confirmed the fact in his repetition of the experiments and added some experiments of his own, and then remarked that they proved the "motor" theory which I had rejected, and he identified the "motor" theory with that of association, indicating that he was following in the line of the assumptions involved in Berkeley's use of muscular experience. But Prof. Judd neither attempts to show how my experiments and his prove the "motor" theory, nor defines what he means by that doctrine. He simply asserts that they prove it. If counter assertion would suffice I would only say that all his experiments simply confirm the position I had taken instead of disproving it. The real difficulty with my critic and this whole school is that they do not define their position in relation to the one I was opposing. I had indicated clearly enough my position in *Mind* (Vol. XIII, p. 524) and this involved the long standing and accepted distinction between sensory and motor functions of the nervous system, a distinction still fundamental in physiology and un-abandoned, except as the psychologists have come to use the term "motor" to denote, not the agencies initiating muscular activity as it originally meant, but the sensation of motion, a fact which is not antithetic to sensory functions at all. The apparent novelty of the

On any conception of "motor" sensations, whether the function of "motor" centers is distinguished from the sensory, or whether they are merely sensory facts involving the consciousness of motion, the quale perceived as a result of binocular parallax is not presented in the image, and this fact is sufficient to prove that the visual percept is not similar to the datum in the sensory impression.

This conclusion is very distinctly confirmed by the phenomena of upright vision, and in a manner which absolutely prohibits the influence of association with tactful and muscular experience. We know that the retinal image is inverted and that nevertheless objects are seen in their proper position. Experiments with a light thrown upon the retina through the sclerotic coat of the eye show that the directional reference of vision is functional and explain why objects are seen in their correct position in spite of the inverted image, and this position is not determined by any principle of vision requiring perception to reproduce the relations in the retina in its judgment of reality. We see objects as they are apparently without any identity between the image or impression and the reality.

It would appear from this conclusion that we may have objects of consciousness which are not "in" consciousness and that perception may "transcend" the states and affections of the sensorium. I do not mean by this conclusion to dispute the idealistic theory of perception. That doctrine is indifferent to what is maintained as the result of binocular experiment. All that I am emphasizing at present is the discrepancy between the retinal and sensorial image and the dimensional quale perceived. Assuming what we know of optics to be true this

"motor" theory comes wholly from the adoption of a terminology which had traditionally implied an opposition to sensory, but which in its new application was identical with the sensory and so lost all power to controvert any sensory theory. I have no objections to the "motor" theory as thus conceived and it does not in the least controvert the claims that I had put forth in dispute of the "motor" theory defined in terms of the physiological distinction between "motor" and sensory functions, one of which was unconscious and the other conscious. This is the reason that I have not been moved by any of the elaborate reversions to so-called "motor" theories. Cf. *Psychological Review*, Vol. X, pp. 49-51.

quale is not present in the impression, but it is distinctly perceived, and though the whole process be "ideal" or subjective, there is nevertheless the difference between what is present in the impression on the sensorium and the percept, a view which lends at least apparent support to the dictum that perceptive consciousness transcends the subjective in its determinations. It is apparent how such a conclusion affects the whole doctrine of knowledge as formulated by that school of idealists who insist upon expressing themselves in language apparently implying that we cannot know anything other than our mental states. Whatever it means, it is certain that we can express the phenomena of vision which are under discussion only in language implying that we see what is not "in" the impression. We seem thus to establish the doctrine of realism in the problem of knowledge.

But the idealist can put in a most interesting reply at this point. He can call attention to the fact that this very discrepancy between the impression and the percept is evidence that the quale is purely a mental construction. This involves the question of the absolute ideality of space, and the phenomena and experiments under consideration may be quoted as proving this fact and as showing the correctness of Kant's doctrine while it indicates the error of Berkeley, at least in the assumptions he made and the method of conducting the argument. If the mind supplies this quale not in the retinal image, the transcendence of the impression may not prove that consciousness is transcended in this percept, as it may be said that the percept is a construction of the mind and not the positing of a reality "outside" the subject. Consequently we would seem to have proved idealism instead of refuting it.

I am not interested in disputing such a claim for idealism. I am quite ready to admit this ideality of space, including plane dimension, and so to accept the doctrine of Kant, only I would contend for the possibility that Kant's conception of the matter may not be what it is usually assumed to be. We may grant that binocular parallax gives rise to the mental construction of the third dimension, yet there is nothing in this fact to prevent the supposition that the construction correctly represents an objective fact. That is, the ideal construction may

have an objective meaning though it has a purely subjective genesis not in the impression. It is the analogy suggested in "subjective" sensory impressions that limits the import of phenomena so described, but if the perceptive act apprehends or creates a quale not in the impression, the distinction thus involved and necessitated by the facts opens the way to the possibility that the percept, though of ideal origin, may have an objective meaning, and the only thing that the psychologist would have to do is to show that there is evidence of that fact. Transcendency of any sort having once been established, its limits must be defined before we can dogmatically assert that perception is characterized by the same conditions as sensation, and if they are not equally defined it is only a question of evidence to determine whether its meaning does not involve more than that of sensation. That is to say, is it not possible that the mind is adapted to construct a quale which represents the actual facts in the external world though these facts are not presented in the impression?

Now Berkeley and Kant admitted the existence of "objective" facts of some sort. Berkeley called them "spirits," and Kant assumed them to be other individual centers of consciousness, social persons. This Kant did in spite of the real or supposed radical ideality of knowledge. There is, therefore, in this admission especially, that it asserts the similarity between subject and object, the possibility that space construction only reproduces the quality of external reality, a conception rendered all the more conceivable from the discrepancy between sensation and perception. But for more suggestive evidence we may recur to the doctrine of evolution. In this we find that there is a tendency of individuals to adjust themselves to environment. In some cases this even takes the form of originating positive resemblances in the subject to qualities in the object. This is specially noticeable in color adaptation. In this phenomenon we observe that the color of an animal may gradually change so to become the same as the color of its environment. It is thus quite possible that evolution might develop in consciousness the capacity of ideal action which would represent correctly the nature of objective reality and not present a fact in antithesis to that reality.

But it is the phenomenon of upright vision that offers the most distinct evidence of the possibility or fact which is here suggested. We have seen that the retinal image of objects is inverted, that is, the relative positions of points in retinal images are the inverse of what they are in the objects which are supposed to produce them. We do not have to go beyond the ideality of these "objects" to recognize this fact. It is a fact on any theory of "objects." A double interest attaches to it. There is a radical difference between the sensory impression and the percept, and the percept reproduces the objective relation and not the subjective. However much ideality we assign to the act of perception in this case it reports the objective fact and not the subjective. What is additionally interesting also is the circumstance that the reproduction conforms to the tactful and muscular quale, so that we might even claim that the visual and tactful data are the same in kind, and thus add an evidence to the nativity of visual space while we sustain its objectivity in spite of its ideal origin. Possibly a further vantage ground could be obtained by suggesting that our conception of the nature of the image or impression is indirectly secured by inference, so that the very assumption of what is subjective may be the wrong point of view with which to start. But this point need not be urged. The main fact of interest is the adaptation of perception to the objective conditions.